day had been wet, so that the falls had a greater volume of water than usual. At that time the sun, as seen from the platform for viewing the falls, was ascending just above the ledge of the rock over which the water was precipitated, and on looking away from it an entire rainbow was visible, excepting that part which was caused by the shadow of the lower part of my body; in consequence of the spray being all round me, the proximity of the bow added brilliancy to the colours, which surpassed anything of the kind that could be seen in a rainbow. I took no measurements.

Can any of your correspondents give examples of bows being seen on a cloudless background? Some years ago I saw a rainbow in what seemed a cloudless sky, but the surprising fact that rain was lightly falling from this apparently cloudless sky shows that if there were not clouds there were drops of water-fall over a large area, and which formed a background. I am aware of Mr. Browning's authority for such a phenomenon.

Birkenhead G. H. H.

Elephas Americanus in Canada

CAPTAIN HOWDEN, of Millbrook, Ontario, has lately discovered remains of this species in a field adjoining his residence. They were found in the humus quite near the surface, and with the exception of the molars have been very much broken by the plough. The locality is a deep basin, depressed 100 or 150 feet below the surrounding hills, which may have been the basin of a small lake or pond. The elevation is about 490 feet above Lake Ontario, and 125 feet above Rice Lake, on the northern slope of the drift-ridge which borders Lake Ontario on the north. The discovery is interesting as extending the range of this animal in Canada, eastward, along this drift-ridge. The remains heretofore discovered have been confined to the western peninsula, above the Silurian escarpment, or to positions so nearly adjacent that they may have been washed down from this upper region. The present discovery is at an elevation which precludes this, and seems to indicate the presence of the living animal in this region. Between the ridge and the present lake shore there are at least two ancient lake beaches, one about 100 feet above the present water level, the other a little over 200 feet. Neither of these would bring the waters of the lake up to the level of the escarpment; so that at the time of these higher lake levels, the elephant may have ranged over the western peninsula of Canada, and also eastward over the drift-hills which extend nearly to the lower end of Lake Ontario.

Victoria College, Cobourg, Oct. 4 N. BURWASH

Reason or Instinct?

CONSIDERATIONS on the nature of Instinct will ever engage the attention of the student of Nature, and certainly interest in the subject is not likely to flag at a time when psychological manifestations and relations are being more and more sought amongst the lower animals. Your correspondent of the 10th of October last touches on their power of enumeration, which, even in the case of the sagacious dog, appears to be very limited. Nevertheless, I have been assured by a reliable friend, now deceased, that his wiry terrier would, at his order, run round the table once, twice, or thrice, for a suitable reward.

The idea of alternation, and an example of memory, came under my own observation some time ago at the Grotto del Cani, near Naples, where I witnessed the somewhat unnecessary experiment of the deleterious effects of carbonic acid on the unfortunate dogs kept for that purpose. On walking to the cave, I remarked that one of the dogs gambolled round the guide, whilst the other followed at his heels with slouched tail and hanging ear. The guide assured me that each dog knew when it was his turn to be dropped into the heavy stratum of gas on the floor of the cave, from whence, after partial suffocation, he is thrown into the cool lake close by for resuscitation.

With reference to the *quasi*-reasoning in adaptation of means to an end, under exceptional circumstances, I adduce the following:—

Many caterpillars of *Pieris rapæ* have, during this autumn, fed below my windows. On searching for suitable positions for passing into chrysalides, some eight or ten individuals, in their direct march upwards, encountered the plate-glass panes of my windows; on these they appeared to be unable to stand. Accordingly, in every case they made silken ladders, some of them five feet long, each ladder being formed of a single continuous thread, woven in elegant loops from side to side. The method here adopted is similar in kind to that employed by the glacier climber, who cuts foot-holes with his hatchet to enable him to mount the icy precipices which impede him.

In the case of the above caterpillars, however, reasoning seems to be but narrow, for one ladder was constructed parallel to the window-frame for nearly three feet, on which secure footing could be had by simply diverting the track two inches. Some of these insects have now passed into pupæ, and are curiously supported or slung by their well-known silken band across the thorax, under the drip-stone of the window. Such facts, though simple, should warn us against dogmatically fixing the points in the animal kingdom at which instinct ends and reason begins. Do they not overlap? G. B. BUCKTON

Weycombe, Haslemere

Lunar Calendars

IN a communication addressed to NATURE for 1871, Mr. S. M. Drach writes at p. 204. "The true mean conjunction derived from the 19-year cycle is called the Molad or Moon-birth," and I wish to ascertain how this so-called "mean conjunction" is arrived at.

I have before me the two new Almanacks published by Vallentine and by Abrahams, by which I find the "moon-birth" generally put down at about six hours after the time quoted in the "Nautical Almanack" for 1873. From facts that have reached me, I conclude that the data for these publications are derived from a skeleton almanack printed by German Jews at Altona, containing the necessary particulars for fifty and eighty years in advance; and no doubt correctly calculated for that locality. I ask whether the data there given are to be accepted by Jews in all countries, or whether they are at liberty to calculate the time of new moon for their own meridian?

I may take this opportunity to point out the following discrepancy:—

True New Moon, Thursday, Nov. 20, 1873, 3.36 A.M.
Moeled Kislev, Wednesday, Nov. 19, 1873, 1.14. 1 A.M.,

according to Vallentine, but marked P.M. in Abrahams. Both the latter must be in error, because in *advance* of true time.

MYOPS

Early Eclipses

IN looking through some back numbers of NATURE, I came on a paper by Mr. Hind, in which he examines whether any great eclipse took place at the time of the Crucifixion of Christ. He says that "although a great total eclipse was visible at Jerusalem in A.D. 29, yet, in the year 33 no eclipse of importance took place." * Mr. Hind seems to have forgotten that in the opinion of most divines, Christ was born four years before the vulgar era, so that in the year 29 He would have been 33 years old. Remembering this point, it seems highly probable that the account of how "the sun was turned into darkness, and the moon into blood" may be a correct account, not only of the occurrence of an eclipse, but of an early observation of the now famous red prominences. G.

Cambridge

Water-beetles

I HAVE to thank Mr. Buchanan White (NATURE, Sept. 12) for the statement that "many water-beetles are not only winged but use their wings." My error as to fact, however, has no effect on the argument of my letter (NATURE, Sept. 5), which was, that although it is probable the first insects emerged from the water with their wings formed, yet the existing aquatic insects throw no light on the origin of the class.

JOSEPH JOHN MURPHY

Old Forge, Dunmurry, County Antrim

PHOSPHORESCENCE IN FISH

IN two recent numbers of NATURE, Nos. 153 and 154, and more particularly the former one, attention is drawn to the question of phosphoric phenomena connected with living fish; but while it has been proved beyond dispute that certain fish, *Cyclopterus lumpus*, for instance, do possess highly luminous properties, the two cases in point may, I think, be referred rather to the combined effects of the microscopic *Noctilucæ*.

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* I quote from memory, and therefore perhaps not quite in Mr. Hind's words.

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During my last dredging cruise off the coast of Portugal, I enjoyed many opportunities of witnessing the brilliant and varied aspects under which such phosphorescence exhibits itself, though instances more strictly parallel with those quoted in the two communications referred to, occurred, perhaps, while returning by steamer from Lisbon, after its expiration.

On such favourable nights, as the vessel progressed through the waters, shoals of small fish might be seen darting away in every direction, themselves apparently luminous, and leaving behind them bright tracks of phosphoric light, while now and then a fish of larger size would make its appearance, producing a similar effect, though of proportionately greater brilliancy. The *coup d'œil* produced by their countless numbers was most magnificent, and in miniature vividly recalled to mind the meteoric showers that periodically illumine our summer nights. On all such occasions as the foregoing, the water when closely examined was invariably found to be literally teeming with *Noctiluca miliaris*, its presence being manifest again in the broad track of phosphoric light visible for many hundred yards in the wake of the vessel, while the shaft of the screw was brilliantly illuminated by their countless numbers, excited into active display of their phosphoric properties by the rapid revolutions of its ponderous blades.

Had Mr. Hall examined the "globules of fatty matter" contained in the spray thrown on deck on the night he refers to, with the aid of the microscope, he would no doubt have traced the light to the same source, and discovered that each luminous point represented a single individual of the tiny rhizopod here mentioned. His hypothesis that they were possibly portions of "fatty matter" thrown off by the fish themselves, seems scarcely tenable, and more particularly if we accept, as we are bound to, that the luminous tracks left behind as the fish swims onwards are attributable to a like origin, and which immediately suggests that such rapid desiccation would exercise as ruinous an effect upon the poor animals' organisation as befell the celebrated racing pigeon of American notoriety, reported to have arrived at its destination bereft of every feather, lost one by one through the friction attendant upon the high rate of speed at which the bird had travelled.

In addition to *Noctiluca*, innumerable other forms, such as minute Crustacea, Salpæ, jelly-fish, &c., contribute towards the ocean's nocturnal luminosity; but all these latter, and more especially the Salpæ, for the most part display their light spontaneously, and are restricted to local and comparatively small areas of the ocean's surface; while in *Noctiluca* that luminosity is entirely latent, being dependent upon natural or artificial disturbance and excitement to bring it into action; and though exceedingly minute, the separate individuals rarely measuring the hundredth part of an inch in diameter, occur in such abundance that the whole surface of the sea is equally luminous when disturbed, being frequently so plentiful off our coasts that their aggregated bodies form a superficial crust of considerable thickness. Disturbance of the water at such times is immediately responded to by sheet-like flashes of luminosity, while any object passing through the water appears to be aglow itself, partly from the direct light, and partly from the reflected light produced by these microscopic protozoa. On the same principle the apparent luminosity of living fish is easily explained. Swimming through the water they necessarily disturb countless numbers of these living organisms, whose emitted light, actively scintillating for several seconds after the fish has passed, produces luminous tracks wherever the fish may travel, while its own silvery scales borrow and throw back the earliest coruscations it awakens in its onward course.

W. SAVILLE KENT

THE FLORA OF THE QUANTOCKS *

THE geological formation and the historical associations of the Quantock Hills have been abundantly investigated. Their natural productions, animal or vegetable, have not yet, so far as I know, been described or catalogued, although they contain specimens in both branches of Natural History singularly rare and sought after, and though more than one zoologist or botanist of note gazes on them daily from the windows of his home. A paper whose conditions are that it should be light and popular, and that it should not exceed ten minutes in the delivery, cannot throw much scientific light upon the plants of the most limited region; but it may reveal sources of enjoyment and raise individual enthusiasm, and it may remind this meeting that the time has possibly come, when our association should use the means at its command to encourage the gradual creation of such a flora and fauna of the county as no single naturalist, unassisted by a public body, can in any case trustworthily compile.

In this beautiful valley, fat with the rich red soil that countless millennia have seen washed down from the surrounding hills, the flora is everywhere so unusually rich as to win the envy and delight of strangers. It has been my lot to pilot botanists from all parts of England in search of local rarities; and I have found their chief raptures given not to the uncommon flower they had come to see, but to the profusion of form and colour which includes almost every English genus; manifest in the common turnpike roads which skirt the hills, but revealed in full perfection to those only who penetrate the interior of the range. In the sheltered lanes of the less wooded combes: in the road from Kilve to Parson's farm, the foot path from the Castle of Comfort to Over Stowey, above all in the lane from the Bell inn to Aisholt, the hedge banks and the wide grass margins of the road are scarcely surpassed in beauty by the mosaic of a Swiss meadow or an Alpine slope. From the beginning to the end of June the colours are blue and yellow; the blue represented by the ground ivy, the germander speedwell, the brooklime, the late bugle and the early self-heal, the narrow-leaved flax, the long spikes of milkwort, and the varieties of the violet; the yellow by the birdsfoot trefoil large and small, the St. John's-wort, golden mugweed, and hop trefoil, the agrimony, the yellow vetchling, and the countless kinds of hawkweed. In the hedges above are the mealtree and guelder rose, the madder, white campion and lady's bedstraw, half hidden by the twining tendrils, white blossoms, and tiny cucumbers of the bryony; while here and there, where the hedge gives way to an old stone pit or deserted quarry, the tall foxglove and the great yellow mullein stand up, harmonious sisters, to fill the gap. By the middle of July the colours shift. The flora of early spring is gone: the milkwort shows its pods, the speedwell its bushy leaves; the yellow still remains; but the blue has given way to pink; to the lovely musk mallow, the horehound, doves' foot cranesbill, restharrow, painted cup, and calaminth. With August a third change arrives; the small short clustering flowers are gone: instead of them we have the coarse straggling fleabanes, ragworts, and woodsage: the great blue trusses of the tufted vetch and the pure white trumpets of the bindweed take possession of the hedges; the yellow sagittate leaves of the black bryony and the red berries of the mountain ash warn us that summer is past. Our September visit marks the closing scene. The flowers are few and far between; but the ivy bloom is musical with bees, the hazels put forth clusters ruddy brown as those with which the satyr wooed the Faithful Shepherdess; the arum pushes its poisonous scarlet fruit between the mats of dying grass; and the meadows which slope upwards from the brooks are blue with the flowers of the colchicum.

These are all common flowers, whose names and habits,

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* Read before the Somerset Archæological and Natural History Society September 12, 1872.

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